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RANGE IMPROVEMENT



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NOTES

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FOREST SERVICE — U. S. DEPARTMENT OF AGRICULTURE
INTERMOUNTAIN REGION — OGDEN, UTAH

STATEMENT OF PURPOSE

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This publication is printed primarily to inform professional range administrators of important range improvement and management developments and findings. These "NOTES" may include extracts of published papers, unpublished preliminary reports of research work, unpublished reports on administrative studies and personal observations or suggestions of other range administrators. No claim is made as to the accuracy or completeness of studies or conclusions drawn.

All who read these RANGE IMPROVEMENT NOTES are encouraged to submit material for publication, or suggestions for improving its usefulness. Full credit will be given for any material used.

TIME OF SPRAYING IS IMPORTANT IN CONTROL OF
LANCELEAF RABBITBRUSH WITH 2, 4-D

W. A. Laycock, T. A. Phillips, and Stanley Randall^{1/}

2, 4-D doesn't
always kill
lanceleaf
rabbitbrush

Herbicide sprays are commonly used to control many undesirable plants on western ranges. For some species, such as big sagebrush (Artemisia tridentata), such sprays usually are quite effective. However, attempts to control lanceleaf rabbitbrush (Chrysothamnus viscidiflorus var. lanceolatus) with 2, 4-D have often been unsuccessful. In 1956, an administrative study was started on the Humboldt National Forest to determine how effectively different times, rates, and chemical formulations of 2, 4-D reduce lanceleaf rabbitbrush and forbs and increase production of grass. Production data taken in 1964 show some of the long-term effects of the different spray treatments.

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STUDY AREA AND PROCEDURES

Effect of time
of spraying
studied

The study area is generally level, at an elevation of 8,100 feet near the Pole Creek Ranger Station in northern Nevada. A 20-acre experimental area was fenced and has been protected from grazing since 1956. Within the area, 12 plots (25 X 75 feet) were left unsprayed and 48 plots were sprayed with 2,4-D, 16 in each of three spray periods. The first 16 plots were sprayed June 22-25, 1956, and the second, August 9, 1956; the third 16 plots received a double spray treatment consisting of applications on August 9, 1956, and again on June 14, 1957.

Two application
rates and two
forms of 2,4-D
used

Separate treatments of low-volatile (butoxy ethanol ester) and high-volatile (butyl ester) forms of 2,4-D were applied at 2 and 4 pounds per acre during each spray period. Sprays were applied in an oil-water emulsion at 20 gallons per acre with a tractor-mounted boom.

Because of personnel changes on the District, the vegetation in the treatment plots was not sampled either immediately before or after spraying. In July 1964, the vegetation in each of the treatment plots was sampled by the weight estimate method.

EFFECTS OF SPRAYING

Different rates
and forms of
2,4-D had
similar effects

The two rates of application and the two forms of 2,4-D used resulted in similar vegetal responses. Therefore, the average production for the rates and forms is reported here for each date of spraying.

June 1956
spray reduced
rabbitbrush
and forbs;
increased
grass
production

Only the June 1956 spray resulted in any lasting reduction of rabbitbrush. In 1964, these sprayed areas still produced 352 more pounds of grass per acre, 195 less pounds of forbs, and 71 less pounds of rabbitbrush than unsprayed areas (table 1). Total production (all herbage) was not greatly changed by spraying. The loss of rabbitbrush and forbs was offset by an increase in grass.

The most important species that contributed to the increase in grass were bluebunch wheatgrass (Agropyron spicatum) and Idaho fescue (Festuca idahoensis). The decrease in forbs was mainly a result of large reductions in production of lupine (Lupinus laxiflorus) and potentilla (Potentilla gracilis). In 1964, these species produced only 5 percent as much on areas sprayed in June 1956 as on unsprayed areas. The other major forbs in the area, yarrow (Achillea millefolium) and Wyeth eriogonum (Eriogonum heracleoides) were not affected by the spray treatment or at least had recovered from any effect by 1964.

August 1956
spray had no
effect

Sprays applied in August 1956 had no lasting effects. In 1964, production of grass, forbs, and rabbitbrush were about the same on both sprayed and unsprayed areas. Observations in the fall of 1956 indicated that the August spray killed the tops of many rabbitbrush plants. Most of the plants sprouted from the base in 1957 and total production was not affected.

Table 1. --Herbage production in 1964 on areas sprayed with 2,4-D at different
dates compared with production on unsprayed areas

Species	Sprayed areas			Unsprayed areas
	June 1956	August 1956	August 1956 & June 1957	
	-----Pounds per acre (air dry)-----			
Bluebunch wheatgrass	298	171	197	144
Idaho fescue	624	478	535	484
Other grass	88	34	48	30
Total grass	1,010	683	780	658
Lupine	4	54	10	81
Potentilla	4	60	6	80
Wyeth eriogonum	26	19	14	24
Yarrow	49	52	58	64
Other forbs	38	67	13	67
Total forbs	121	252	101	316
Shrubs (lanceleaf rabbitbrush)	63	141	240	134
Total production	1,194	1,076	1,121	1,108

Double spray
reduced forbs
but increased
rabbitbrush

Rabbitbrush actually increased in the areas sprayed in August 1956 and resprayed in June 1957. In 1964, these sprayed areas produced 106 more pounds of rabbitbrush but 215 less pounds of forbs per acre than unsprayed areas. Grass production in 1964 was only slightly higher in the sprayed areas but not significantly so. Total production was not affected.

REASONS FOR DIFFERENT RESPONSE

Why did the spray treatments at the different periods produce such widely differing results? Conditions of plants, soil, and weather at the time of spraying are mainly responsible, but resprouting of rabbitbrush was also important.

Warm weather,
moist soil, and
active growth
of rabbitbrush
needed for
good kill

In June 1956, weather was warm, the soil was moist enough for continued plant growth, and rabbitbrush was almost in full leaf. Other studies (Hyder and others 1962; Cook and others 1965) have shown that these conditions probably were ideal for maximum kill of rabbitbrush and forbs. The resulting reduction of competition allowed the grasses to increase in vigor and production.

Dry soil and
plants prevent
effective kill

In August 1956, soil and plant conditions were not favorable for killing rabbitbrush or forbs. The study area had received almost no rain since mid-June and the soil was quite dry. Because of the dry soil, rabbitbrush was not actively growing. The forbs had all matured and most were so dry that they were no longer susceptible to spray. Thus, the August spray had little effect.

Rabbitbrush
increased
when only
forbs killed

The increase of rabbitbrush in areas sprayed twice is more difficult to explain. The first spray (in August 1956) had little effect. The second spray the following June did not kill the rabbitbrush because (1) the rabbitbrush was just starting to leaf and probably had not developed enough to be susceptible, (2) the temperature was cool, and (3) a heavy snow that fell the night after spraying in June 1957 may have reduced the effectiveness of the 2,4-D enough so that the rabbitbrush was not killed. The forbs were significantly reduced by this spray, however. The rabbitbrush plants which were not damaged or which resprouted increased in vigor and production as a result of the reduced competition from the forbs.

DANGERS OF IMPROPERLY APPLIED SPRAYS

Sprays applied
at the wrong
time can in-
crease
rabbitbrush

Most species of plants are unaffected by herbicides applied at the wrong time --the money invested in the spraying operation is simply wasted. However, because of its competitive ability and its ability to resprout, rabbitbrush can actually increase if sprayed at the wrong time. When this happens, not only is money wasted, but land value for grazing is lowered. Therefore, spraying must be timed with great care.



Other herbicides
may be better
than 2,4-D

Researchers are now experimenting with other herbicides which appear to be more effective than 2,4-D for killing rabbitbrush. The most promising is Tordon 22K^{2/} (picloram) (Cook and others 1965; Tueller and Evans 1965). However, further research is needed to determine its effect on rabbitbrush and associated species when applied under different conditions of temperature, plant development, and soil moisture.

BENEFITS OF PROPERLY TIMED SPRAYS

Properly timed
sprays result
in lasting
increase in
grass
production

Properly timed applications of 2,4-D can result in lasting reductions of forbs and rabbitbrush and increased grass production. Hyder and others (1962) and Cook and others (1965) have reported increases in grass production shortly after successful spray operations. The June 1956 spray in the Pole Creek area was applied when soil moisture, plant development, and temperature conditions were at optimum levels; it resulted in increased grass production. After 8 years, sprayed areas still produced 352 more pounds of grass per acre than unsprayed areas.

^{2/}Dow Chemical Co. registered trademark for a formulation of 4-amino-3,5,6-trichloropicolinic acid. The use of the trade name of commercial products is solely for identification and does not imply endorsement by the U.S. Department of Agriculture or the Forest Service.

Will increased
production
repay costs?

Is the increased grass production enough to justify the expense of a spray program on cattle range? The following assumptions must be made before this question can be answered:

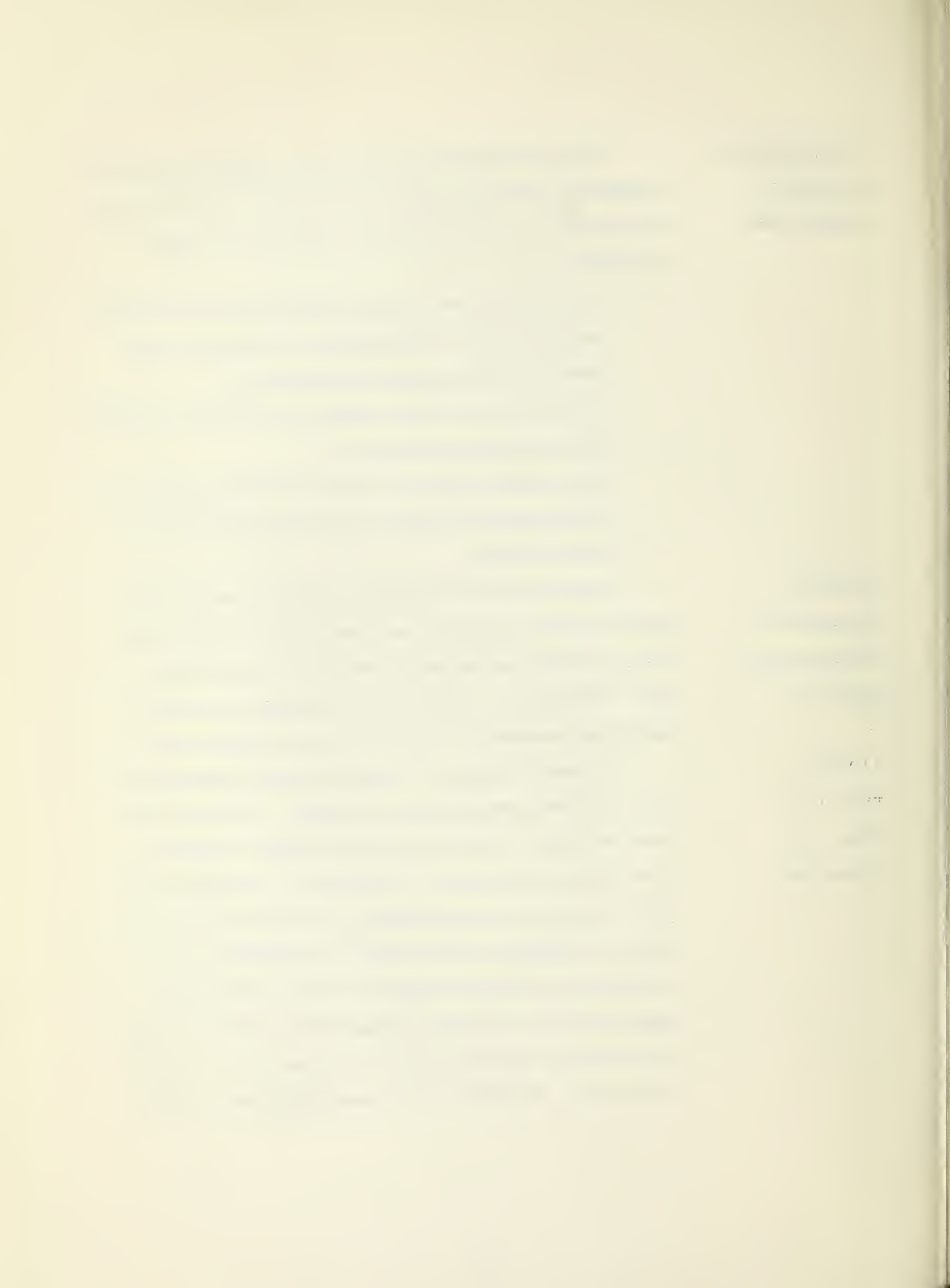
- (1) The difference in production between sprayed and unsprayed areas is the same as it would be if both areas had been grazed since spraying.
- (2) Cattle will consume about one-half of the increased grass production each year.
- (3) A mature cow with a young calf will consume about 28 pounds of dry feed per day (National Academy of Science 1958).

Capacity
increased 0.2
AUM per acre
per year

Based on these assumptions, the increased grass production would increase the carrying capacity of the range about 0.2 AUM (animal unit months) per acre per year ($176 \div (28 \times 30)$). If we assume the value of an AUM to be \$3, this increase is worth \$0.60 per acre per year.

11 years
required to
repay cost
of spraying

It costs \$5 per acre to spray 2,4-D at 3 pounds per acre, the rate commonly used at present. We must determine how long it will take the \$0.60 benefit to repay this cost at 5-percent interest. Since interest is charged each year only on the remaining balance, we must use a capital recovery multiplier (often called an amortization factor) to establish an average annual cost equal to the average annual benefit. An average annual cost of \$0.60 is reached in 11 years and the total cost of the project will be repaid in that time. By 1964, the increased grass production on

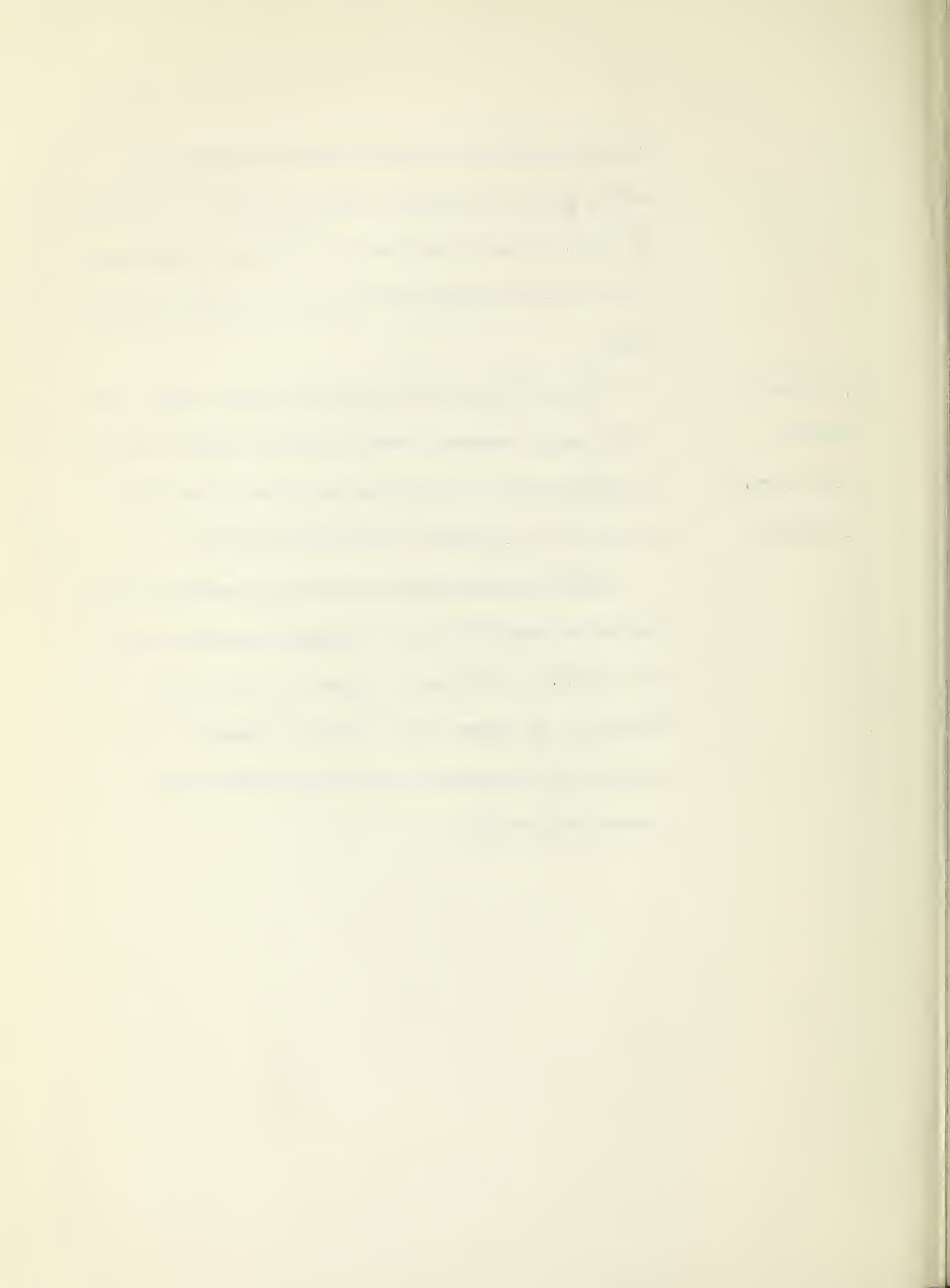


the sprayed areas had persisted for 8 years, so it undoubtedly will persist 3 additional years. Therefore, the spray program will pay for itself and be an economically feasible range improvement technique on cattle range.

Spraying not
desirable
under certain
conditions

The above calculations apply to cattle range. On sheep range, however, the reduction in forbs accompanying the kill of rabbitbrush would be undesirable and the range probably should not be sprayed.

One factor not considered in the economic evaluation is the possible role of nitrogen-fixing bacteria in the nodules on the roots of lupine in overall soil fertility. On ranges where lupine is abundant, reduction of this species over a long period might reduce soil fertility.



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Be on the SAFE side - THINK

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A JIGGER OF TORDON HAS SUCH A WALLOP IT'S ALMOST SCARY*

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Since the introduction of 2,4-D, probably no herbicide has received as much attention as the new compound Tordon. The compound was released in small quantities to most research people in the spring of 1963. There had been considerable research work conducted prior to its release by selected research stations and, of course, the working force of Dow Chemical Company.

I can remember very clearly how critical I was of company representatives when they quoted figures in ounces per acre and very seldom over 2 pounds per acre active material and the results that were being obtained.

Farmers and ranchers were prime for acceptance of a compound of the nature of Tordon. Compounds researched since the introduction of 2,4-D were not always consistent. At rates necessary to obtain outstanding control, many were of the soil sterilization nature and cost upwards to \$100 per acre.

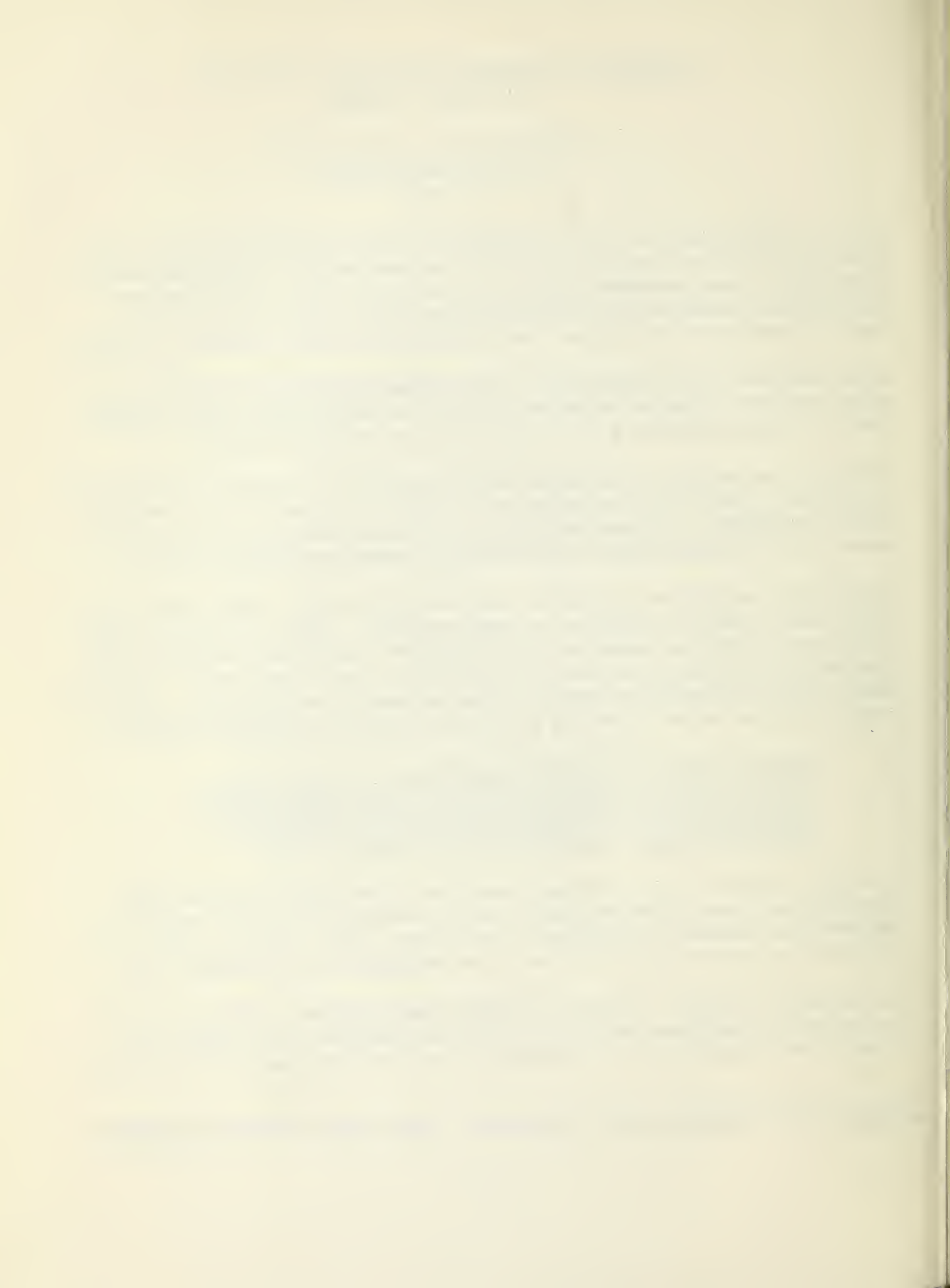
Tordon was immediately accepted. Enthusiasm ran high. Here was a compound that would give complete, or near complete, control for Canada thistle, leafy spurge, Russian knapweed, field bindweed, milkweed, and many other species at low rates of application. When used at the proper rates of application it would not seriously damage the associated grass vegetation. Time of application was not as important as with the phenoxy and other compounds.

We have a policy in the Wyoming Experiment Station to research any new herbicide for three years before making recommendations. We have been severely criticized for withholding recommendations for this length of time.

Actually, the three years that compounds are in the hands of researchers give only two years of usable data. It is impossible to develop a program whereby the complete information on selectivity, soil residual, toxicity, effect upon associated vegetation, etc., can be gained in that length of time.

Our policy, of course, provides no control over what any individual farmer or rancher or applicator may use or do in the meantime, but it does prohibit the Weed and Pest Control Districts from reimbursing for the chemical.

*Copied, by permission, from December 1, 1966, issue of UTAH FARMER.



Still, there was a considerable amount of chemical used at full price in the districts and when the Wyoming Experiment Station finally recommended Tordon in the summer of 1965, the use mushroomed to a point that it was impossible to find any amount in Wyoming or Colorado last fall.

I don't think there was or is anyone in research and extension weed control more enthusiastic concerning the potential of this compound than I.

The latest three years of my extension responsibilities have been very enjoyable. I have been able to discuss the control of perennial weeds without someone putting me behind the eightball. Previously, after I had talked to a group for 30 to 40 minutes on perennial weed control, someone would stand up and say, "Now that you have spent all this time, what can I use to actually kill Canada thistle?" I can assure you that this has not happened since the introduction of Tordon. It will definitely do the job!

We have had some very unfortunate cases of Tordon misuse in Wyoming. Possibly the only reason they have not been of greater magnitude is that we are predominantly a range state and do not have the acreages of beans, potatoes and susceptible broad-leaved row crops that are common in other states.

First, let's consider what was originally on the label. The 1965 label read: "For spot treatment of crop land, remove area actually treated from crop production, as residues may result in crops."

The 1966 label was changed and made more inclusive. "For spot treatment of crop land, remove areas actually treated from grazing and crop production, as residues may result. NOTE: Do not plant grass crops used for food, feed, or grazing until two years after last application. Do not plant broad-leaved crops for three years because of possible adverse effects on growth."

Evidently, the restrictions prescribed on the label were NOT taken into consideration.

Second, spray application equipment was not calibrated. Probably one of the weakest links in an effective weed control program is calibration. I have personally conducted calibration schools throughout Wyoming. I was many times fortunate to even have the owner of this spray machine available.

With the introduction of Tordon, at \$40 per gallon, I felt that calibration would be the first objective. When one realizes that a cup of Tordon costs \$2.50, or approximately \$1 per shot glass--twice as much as good bourbon--there should be some concern. I am sure that anyone who has misused Tordon would not treat a fifth of his favorite spirits the way he did this new herbicide.

Our first incident of damage was in 1965. A farmer in the Big Horn Basin had 4 or 5 square rods of Canada thistle at the head end of an alfalfa field. He purchased a quart of Tordon from a local dealer. Instructions were to mix the quart of chemical in 50 gallons of water. The entire mixture was applied to those 4 or 5 square rods and irrigated through the treated area..

Result: Dead alfalfa for a quarter of a mile through the field.
This was enough chemical to treat 1/2 of an acre.

An aerial applicator sprayed 40 acres of leafy spurge. The next day he sprayed alfalfa with Malathion. Result: A very sad-looking field of alfalfa.

A farmer in cooperation with the weed inspector sprayed a main lateral in the fall of 1965. The first water in 1966 caused considerable damage to part of an alfalfa field.

Another farmer treated an irrigation lateral and irrigated his beans three weeks later. He had no idea of what rate was applied. Again, he had simply mixed 1 quart of Tordon per 50 gallons of water.

A small town had all of its alleys sprayed with Tordon.

Probably the most interesting incident was one in which considerable bean damage was prevalent in a field where NO chemical had been used! Believe it or not, this actually happened.

It had not come through the water because the damage was not general down the rows but spotted. Final analysis was that it came through manure that had been spread in the field. Livestock grazed a pasture that was spot treated in 1965. The animals had been corralled each night and the manure spread on the field planted to beans.

Considerable damage occurred in potato fields where the chemical was applied in 1965. Potatoes seem to be one of the most susceptible crops.

Many of you have probably heard about the reported fish kill in Wyoming due to the use of Tordon. This was a false accusation and this problem has been straightened out.

Tordon is a very potent compound. We have not been able to impress this upon applicators, farmers and ranchers. Dow Chemical Company has stated that it has 20 times the killing power of 2,4-D. Possibly it has omitted a zero.

Tordon is soil residual and persistent. However, application rates in magnitudes of 2 to 20 times the amount needed to do the job have been used.

Unless we are able to impress upon all who use this compound that it is not another 2,4-D, and if the old theory that if a little does a fair job a lot more should do a better job is not squelched, we may see more severe restrictions against what now appears to be one of our more promising new chemicals.

* * * * *

A self-made man recently said
that if he had it to do over again,
he'd get some help.

Annon.

* * * * *

Life's but a brief lesson
and
school is out before we know it.

Annon.



